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SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

July begins Volume VII, another chapter in land defense. Defense of a land increasingly precious under threats from within and from without. July also sees Winter's waters roll down from the mountains—a bounty for thirsty crops. The story starts on page 3.

UNITED STATES DEPARTMENT OF AGRICULTURE – WASHINGTON

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WELLINGTON BRINK
EDITOR

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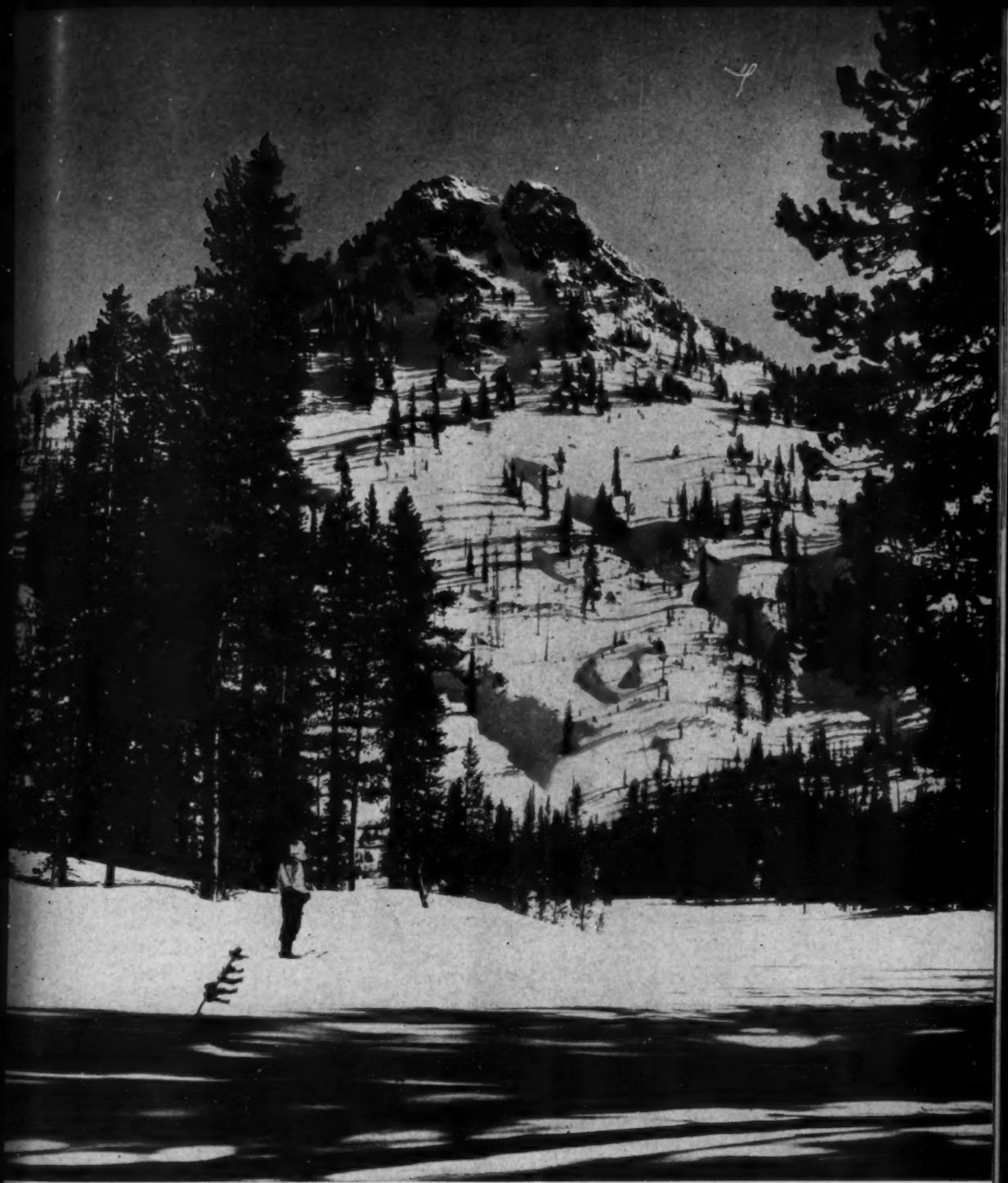

Gunsight Peak in the Elkhorn Mountains is well named. It forms a background of grandeur for the Anthony Lake snow survey course.

The Santa Claus chimney affords ready access to a cabin buried above the eaves. The chimney was developed by R. A. Work, of Medford, in charge of Service snow surveys in Oregon. R. W. Childreth, Service snow surveyor, here is halfway in and halfway out.

SOIL CONSERVATION

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SNOW WATER

By FRANK B. HARPER and JACK G. JAMES[1]

A HUNDRED or more men—and a woman—on skis and snowshoes went far up into Oregon's key mountain ranges during the winter and spring and gathered information, at its source, as to what the coming season's water situation will be after the snow has finally melted and is "showing up" in the streams and springs through the valleys below.

The information is a vital factor in proper irrigated land use and in the economic planning of thousands of farmers on hundreds of thousands of acres of Oregon's most productive lands. It enabled irrigation farmers of all but the southeastern and far-eastern areas of Oregon to know that they are going to be short of water before the summer is out. It gave them the chance to work overtime this spring to get early run-off water over their crop and orchard lands, turn under their cover crops much earlier than they liked, and to decide to summer-fallow large acreages instead of seeding new clover or planting sugar beets or other crops that require late-season water.

It is simple enough to sit beside the radiator or in the warm spring sunshine and read about this business of measuring the snow for its water content. It is a different matter altogether, however, to go along on one of these jaunts—doing work that is everyday routine for Associate Irrigation Engineer R. A. Work, of Medford, and his small army of snow surveyors.

Regional Conservator J. H. Christ in Spokane said that it was "all right with him" for us to make the trip as long as Mr. Work, J. C. Marr, and W. W. McLaughlin were willing to risk letting a couple of "crackers" out on the trail. It turned out that these leaders were willing, and thus we headed for Enterprise, Oreg., with heavy clothing, snowshoes, and other gear including zinc ointment and lipstick for snow burn, in sufficient quantity to suggest a trip to the Antarctic.

It was the time of the final spring snow survey, when some 2,000 men in States west of the Mississippi were setting out for the mountains to make what amounts to a "count" of this "lifeblood of the West," as Work calls it—snow. Some of the most inaccessible courses can be measured only once during the season. The majority of them are visited at least twice, for the final spring check and for the midwinter measurements the first of February. Still others are checked once a month from November to May, as on Mount Hood in the Cascades. All of the approximately 100 courses in Oregon are sampled about April 1. Irrigation power, navigation, financial and many other interests with a stake in the snow, and the water it provides, must know before mid-April what they can depend upon so that they can shape their plans accordingly.

An early start was imperative if pictures were to be taken on the 7-mile climb, and also to make the grade up along the East Fork of the Wallowa River past two rather hazardous snowslide areas before the spring sun could loosen the snow clinging to the rocky sides of the trough between the 8,000- to 10,000-foot peaks of Wallowa Mountain. We learned of the snowslide danger after our arrival at Enterprise, while we were busy assembling our gear against the 4:30 a. m. start for Joseph, headquarters of the Northwest's famous Chief Joseph of another day.

Max Wilson, attorney for the Associated Ditch Cos., who regularly takes the Aneroid Lake measurements, joined us at Joseph with his son, Keith. Apparently, Work felt that an extra hand might be

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useful should one of the tenderfeet fail to make the grade.

Our first 1⅛ mile amounted to 1,400 feet of climbing after which the trail led up through the timber, across ice-covered foot logs and along open snow fields in the direction of the 7,500-foot level of the Soil Conservation Service snow survey course on the edge of Aneroid Lake. Nor did the snowslide precaution prove to be mere guesswork on the part of our leader, although the trip up was without actual incident beyond a momentary scare. When we reached the first slide area, Work instructed us to string out, 50 or 60 yards apart, while crossing.

"Is it," we asked, "because too many persons walking across together would set up vibrations and jar loose the snow above us?"

"Partly, yes," he replied. Then he added comfortingly: "And, of course, this way, if a slide comes, you lose only one or two men, not the whole party."

Work was breaking trail, followed by James in his ski tracks. Next, Wilson senior on bear-paws, then Harper on Alaska webs, and Wilson junior bringing up in the rear on skis. Work and James were across and Max Wilson nearly so; Harper was half way over and wondering how he could run in his webs. Young Wilson had just started. A low whistle sounded a warning. Up above, the snow was starting to move in little ripples on the smooth white surface.

"Get across!" came the more imperative warning.

Ragged, broken trees and stumps and other tall trees partly uprooted, in a big fan-shaped patch below the trail to the river, testified to the power of countless tons of sliding snow that had let go at this very spot a couple of years before. The order to get across quickly was good advice, although this time our slide fortunately turned out to be a dud.

We entered the well-constructed, amply stocked Soil Conservation Service shelter cabin through the attic door well above the 1940–41 light-snow height. It was too late to make a visit to the snow course; besides, there was the business of building a fire, shoveling steps to the lower door, carrying water from the spring-fed creek, cooking dinner from the provisions in the frost-proof concrete cupboard beneath the wood range, and making down sleeping bags on table, storage chest, and even the floor to accommodate five in a cabin with bunks for the normal survey crew of two.

Work and Irrigation Attorney Wilson made harmless bets on how deep the snow would be on the mountain-meadow course and how many inches of water the snow tube and scales would show. Young Wilson finished his self-appointed tasks as chief cook. James snapped an occasional picture of snow surveyors in the field. Harper made notes as the others discussed the objectives of the survey:

"You can't tell how much snow and water there is up there merely by looking out the window," Work was saying as he glanced toward the snow-banked window for emphasis.

"I agree," replied Wilson, "and I know that our farmers count on these surveys. In fact, I don't believe any place in the State depends so much on the snow surveys as the upper part of the Wallowa Valley with its 17,000 acres or so under the ditch. Our land will net an average of $30 an acre, in peas, grain, hay, and all other crops. Although a low water content means that the farmers must turn to summer-fallow to make the water reach—and every thousand acres of summer-fallow subtracts $30,000 from their year's returns—yet if they planted without having this snow forecast information, not only would they lose this income but also their seed and labor."

Someone stepped outside to get the snowshoes, and reported that snow was falling.

"The difference of only a few inches in the snow's water content means thousands of dollars to our farmers," Wilson took up the cue as he reloaded his pipe. "Before 1929, we had to depend on somebody's guess—not a very reliable method. I believe that the snow survey work is worth fifty times what it costs. Our farmers' investment includes the $160,000 storage reservoir, with a 45,000-acre-foot capacity; and every foot of that storage comes from the Wallowa River watershed where these snow surveys are made."

Because of donations of time and other services by 23 cooperating State and Federal agencies, power companies, and other public and private interests in Oregon, where all the snow surveys are correlated by the Soil Conservation Service in cooperation with the State Experiment Station and the State Engineer, the, cost now is almost nominal. It seems negligible even as contrasted with the worth of the results as described by Wilson during our swing through the Wallowas, the Elkhorns, the Blue Mountains, and the Southern Cascades and into the valleys of the Malheur, the John Day, the Grande Ronde, and other rivers and drainage basins.

Snow surveys were started in Oregon in 1928, through the State Engineer's office. A year or so before that date the California-Oregon Power Co. had begun making measurements, although the data were not made available to farmers until after 1935 when the United States Department of Agriculture, through

How much? With tube and scales, the snow surveyors measure and weigh the snow on the permanently marked course to find its depth and water content, as an index to the storage on the watershed and as a basis for forecasting the summer's supply of water for irrigation, power and other uses. A. E. Kenworthy takes the sample; R. A. Work makes the record.

The snow was light this year. Otherwise it would be banked even higher around the shelter cabin at the end of the trail. R. A. Work and Max Wilson here approach the Aneroid Lake snow survey cabin in the Wallowa Mountains.

the Bureau of Agricultural Engineering, became the national coordinator of all snow survey work in order to assure complete and continuous records. At the same time, all the State courses, many of which had been dropped in the early 1930's, were reestablished and several new ones were set up.

Today, the snow measurements are made by United States Forest Service and National Park Service rangers, Geological Survey stream gaugers, power line patrolmen, Fish and Wildlife Service hunters, county watermasters whose budgets include snow survey funds in counties affected, irrigation district managers and many others. They cover approximately 4,000 miles of rough mountain terrain each winter, with one trip alone in the Cascades calling for 120 miles of travel on skis. The Soil Conservation Service has 13 snow survey cabins in the Oregon district, each equipped to shelter two men for 2 or 3 weeks in an emergency—one man never goes alone on this hazardous mission. It cooperates with the Forest Service, the Geological Survey and others in stocking 17 additional cabins belonging to these agencies.

Through the still falling snow—about the first of any consequence since early February—we went across frozen Aneroid Lake early in the morning to the snow course. Each sampling station is marked by bright black-and-yellow signs on tall red-and-yellow steel posts set in concrete; thus every measurement is certain to be taken at the same spot from year to year. The 1¼-inch aluminum tube was lowered 77.8 inches before its saw-tooth end struck the dead grass and black unfrozen soil below. Nearly 6½ feet of snow seems enough to suit anybody, but it was almost 10 inches less than the 1940 spring measurement, which of itself was nothing to boast of. The hand scales, correspondingly graduated to show the inches of water in the column of snow brought up in the tube, revealed that the average water depth was but 28.4 inches.

Upon our return to Enterprise, Watermaster Steele cut short his Sunday dinner to pick up the snow measurements. In the 13 years since the Aneroid Lake surveys were started, only four surveys have shown snow depth and water content lower than those of 1941. This is not as discouraging as it seems, however, because the increased early season storage in Wallowa Lake and the expected stream flow from the East and West Forks that supply it, warranted a forecast for the summer of 6,000 to 7,000 acre-feet more water for the upper valley's ditches.

"The snow survey information is most important from the watermaster's point of view," Steele explained. "Farmers are constantly asking how much water there will be. If the snow is short up there, the watermaster must work the water around in order to make a fair distribution."

The trip was to disclose, however, that to the west and south where the mountains missed the late snow-laden California storms, there was cause enough for worry in 1941. The snow lay only in

inches-thin patches on Blue Mountain summit, where normally it is measured in feet at the same time of year. We visited this snow course with Superintendent John Updegraff of the Warmsprings Irrigation District, and his daughter, Mona, who more than once has made the 50-mile trip on skis to the two other courses her father measures regularly. The snow crop was shorter than usual at Anthony Lake up in the Elkhorns, where District Forest Service Ranger A. E. Kenworthy remarked that "the farmers can hardly wait until I get to town, to learn the official snow depth and water content figures."

At Crater Lake, the 8 feet of packed snow on the level, as measured by Ranger Wilfred T. Frost of the National Park Service, seemed ample enough to the uninitiated. In 1938 there were more than 15 feet of snow, and nearly 62 inches of water for the thousands of irrigated acres and the power plants below, as contrasted with less than 40 inches of water this year. At Seven Lakes, 16 miles uphill into the Cascades west of Fort Klamath, where James accompanied R. W. Childreth and G. F. Sturdevant, snow surveyors for the Soil Conservation Service and the State experiment station, the snow also was short. After the grueling trip over rough, frozen snow they found that the "Santa Claus chimney" tower designed by Work for finding and entering the snow survey cabin in deep-snow years was exposed almost down to the roof of the cabin.

Winter was leaving the mountains early, with a proportionate shortage in late-season snow, and the bears were coming out of hibernation before the usual time. One gaunt, hungry yearling stood on the snow begging for a handout from passing cars along the Crater Lake road, where an older bruin had blocked traffic between the high snowbanks a few days before, until Park rangers herded him off into the timber. A fresh track, nearly two handspreads across, was seen on the trail to Seven Lakes.

The short-wave radio at the Medford office brought similarly unwelcome news of snow shortages from other snow surveyors within a radius of 250 miles.

Snow surveyors work out their computations at the earliest possible moment after taking the measurements, to have accurate forecast data for prompt relaying, sometimes by short-wave radio, to irrigation, power and other interests waiting for them. R. A. Work, left, is doing his figuring on a piece of board; Max Wilson, right, attorney for the Associated Ditch Companies in the Wallowa Valley, completes density and other tabulations from measurements taken an hour earlier on the Aneroid Lake snow course in the Wallowa Mountains.

A close-up of sampling. The accuracy of many such measurements determines the accuracy of the water forecasts.

"I have some snow measurements for what little snow there was to measure," came one report.

"The water is so short," another surveyor complained, "that the creeks look more like the last of April than near the first of April."

Good or bad, the figures were relayed by the next mail to waiting watermasters, irrigation district managers and others in the territory affected, to be considered along with stream-flow and other available data in the half-dozen water forecast meetings held in different parts of the State before the annual mid-April meeting of the Interstate Columbia Basin Forecast Committee at Portland. There, Oregon, Washington, Idaho, and Montana representatives were cautioned that the 1941 water-supply conditions of the Columbia River basin might be among the worst in recorded history.

The snow-water forecasts are recognized as accurate and dependable by the farmers and other water users. One hundred and twenty of them, covering most of Oregon's important watersheds, were issued between July 1, 1938 and June 30, 1940. About 400 copies of the final April 1 forecast were mailed from Medford this year. That the Oregon snow surveyors, with their colleagues in other western States, are doing a pretty good job of taking the guesswork out of their business is indicated by the fact that in 1940, 85.4 percent of their forecasts were 80 percent correct or better. Mr. Work frankly considers this a "not half-bad showing" when taking into account such unpredictable additional factors as spring and summer rains, chinook winds, rate of thawing, evaporation, etc.

A dozen or more men on the "consumers' " end of snow surveying bore witness to this as we took a hurried informal poll across the State:

Harvey McAllister, farmer near The Dalles, remarked as follows: "I had planned on planting some more alfalfa this year, but now I'll not do it. Every forecast I've watched thus far has been borne out, even if some of the old timers do still say it's all tommy-rot."

Ed Judd, manager of the Medford and Rogue River

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Valley Irrigation districts had this to say: "The snow measurements will check accurately to within 5 or 10 percent, if the spring is a normal one. By forecasting a short water year, we can keep the farmers from making expenditures for seed, labor and use of their land."

George Cochran of La Grande is a member of the President's Reclamation Repayment Commission, and vice-president at large of the Oregon Reclamation Congress. He lamented the fact that the LaGrande Valley water table has dropped as a result of the draining of the sloughs; he censured waste of irrigation water through failure to use soil- and moisture-conservation methods. "The snow survey is certainly a big thing," he said. "The county agents should send to the farmers, along with the forecasts, statements on how to arrange their planting to meet the water conditions. It is a matter of dollars and cents to the farmers."

Ray Larson of Nyssa, who is district manager of the Amalgamated Sugar Co., made this statement: "About the first of January I start watching for the snow survey reports. If they are not in by the fifteenth, I begin to wonder where they are. Last year, had it not been for this information, we would not have planted an acre in the Brogan area; but with the report we went ahead with about the usual acreage, and it worked out all right."

E. Reed Carter, secretary-manager of the Grants Pass Irrigation District, was found early in the morning in the office of County Watermaster Tom R. Pearce, studying snow-survey figures we had heard coming in over the radio at Medford the evening before: "If we had listened more to the snow survey forecasts last year, our estimates would have been closer. We plan our operating season from the snow information. We have found that the estimates in this county since 1937 have been within 2 or 3 percent of the actual figure."

The snow survey courses of the western mountains are far off the highway—and no ski lifts to haul the surveyors up. R. W. Childreth leads the way and G. F. Sturdevant follows, on a trail in the southern Cascade Mountains west of Fort Klamath.

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THE ALABAMA CONSERVATION PLAN

By J. N. LOWE [1]

WHILE attending a training school for AAA committeemen and soil conservation district supervisors in Pike County, Ala., I got a new conception of how farmers may make their soil conservation district the instrument for solving many of their problems. This training school, a part of the program for developing the "Alabama Plan," was held in the Wiregrass Soil Conservation District in the southeastern part of the State where the agriculture consists principally of growing cotton, corn and peanuts, and raising hogs.

The type of agriculture of the area involves many complicated problems. There is need for winter cover following peanuts dug for market; for sodlike crops in the rotation; adapted winter legumes that produce seed regularly; adequate fencing; early summer grazing for hogs; for pasture development; for proper disposal of run-off water, and other sound farming practices.

The encouraging feature of this gathering of farmers was the willingness of the group to "tie into" the problems and use all information at hand for their solution. These farmers are leaders in their respective communities and they were given the responsibility of helping their neighbors to determine a solution to the conservation problem.

[1] Assistant chief, regional agronomy division, Southeastern Region, Soil Conservation Service, Spartanburg, S. C.

Kudzu being utilized for temporary grazing for hogs on critical slope formerly cultivated. Old bench terraces are in the background.

It has been wisely said that if the soil is to be conserved, it will be through the efforts of those who occupy the land. As I observed this group in action, I became convinced that the job can and will be done when satisfactory solutions to the problems are demonstrated.

It is recognized in the Wiregrass district that the low bottomlands are the most desirable sites for pasture. Many farms have very little, if any, such land available. In studying this problem, it was found that M. W. Redd, a dairyman near Ozark, has developed a practice that will help solve this problem. On a well-fertilized loamy sand hill he uses a mixture of oats and vetch for winter grazing; for summer grazing he uses Bermuda grass. The oats-and-vetch furnishes some grazing during the winter and early spring and is harvested later for hay. The Bermuda grass provides excellent grazing throughout the summer.

Last fall, farmers cooperating with the district planted 13,000 pounds of blue lupine seed for winter cover and seed production. These plantings are being studied in an effort to solve the problem of producing winter legume seed locally. The winter legumes grown in the South consist mostly of vetches and Austrian winter peas. These crops are not dependable seed producers in this section. A winter legume that consistently produces seed under Southern conditions would be extremely valuable in the conservation program.

The training school in Pike County was a 3-day

Meadow outlet for water disposal. Note terraces entering meadow strip from cultivated land on each side.

Crotalaria seeded in March on small grain for soil protection and improvement.

meeting, conducted jointly by the county agent, the AAA administrative assistant, and the Soil Conservation Service work unit technician. The first two days were spent in the field studying two farms, one that had been planned by Soil Conservation Service technicians and on which conservation practices had been established, and the other an unplanned farm on which virtually no conservation measures had been established.

Each member of the training group was given a land-use map of the planned farm and as the group walked over that farm each phase of the planned program and each practice was explained and discussed. The unplanned farm was used as a "problem" farm and each one present was given a work sheet and a base map of the farm and asked to prepare a suggested land-use map, showing locations he would propose for waterways, pastures, and perennial strips of kudzu and *Lespedeza sericea*. Each member of the group also was asked to decide which fields should be terraced

and to discuss the cropping practices necessary to maintain and improve the land remaining in cultivation.

The last day was spent in conference, working on the problem farm. This farm was in a run-down condition and much of it was unfit for cultivation. Each member of the group submitted his work sheet and suggested plan to the chairman and he, in turn, selected the papers at random. As each man's paper was brought up for discussion he was asked to outline his plan for the problem farm on the large map provided for that purpose. When each man had finished his plan, the group was given an opportunity to discuss it. At times the discussion became rather warm, but these farmers were learning what their conservation problems were and how to solve them.

It developed that a large, good-natured committeeman owned the problem farm. The uncomplimentary remarks directed at his farm had not disturbed him in the least because he was eagerly seeking a workable solution. From his neighbors he had received many suggestions, some good and some bad; and when given a chance to speak he did a very good job of separating the wheat from the chaff in formulating a plan for development on his run-down land.

Briefly this is how the "Alabama Plan" is functioning at the grass-roots level, where conservation leaders are being trained in every community in the 67 counties of the State. Those in charge of the AAA program are conscientiously seeking methods for getting more conservation on the land. With this in mind, the Alabama Agricultural Conservation Committee has formulated what is known as the Alabama Farm Conservation Plan. The plan was approved by the Agricultural Adjustment Administration; members of that agency have recognized that worthwhile accomplishments usually are made according to a definite plan.

The minimum conservation requirements under the plan, or in other words the 5-year goals, are as follows:

1. To grow on cropland *each year* an acreage of erosion-resisting and soil-conserving crops equal to at least 25 percent of the cropland.

2. To terrace properly and maintain terraces on all cropland on the farm which is subject to erosion and is not in permanent vegetative cover.

3. To establish and maintain perennial soil-conserving crops approved by the State AAA Committee, including kudzu, *Lespedeza sericea*, and alfalfa, on at least 1 acre for each 15 acres of cropland.

4. To establish and maintain permanent pasture on at least 1 acre for each 15 acres of cropland.

A system of points for each of the requirements was worked out so that each farm could qualify by carrying out one-fifth of the total requirement in 1941. For each 2 percent by which the 1941 goals are not met the payments with respect to cotton, tobacco, wheat, and potatoes will be reduced 1 percent.

It was realized that to make such a plan effective it would be necessary to coordinate the thinking of agricultural workers and leaders, and to develop in the minds of the people a genuine philosophy of conservation. Therefore, the workers at the State and area levels were the first among those to be given a training course. The plan for conducting the educational program was worked out by representatives of the Alabama Extension Service, the AAA and the Soil Conservation Service.

The plan included a training school for those in the State and area levels; 12 district schools for district and county workers, including the 3 county AAA committeemen; a school in each county for AAA committeemen and the soil conservation district supervisor; and, in addition, farmer-training meetings in every community of the State.

So far as I know, this is the first full-fledged, State-wide cooperative attack on the conservation problem that has been made. Everyone from the State Administrator to the farmer had a definite part to play. This is obviously a big undertaking. However, we felt that the late W. D. Bently, director of extension in Oklahoma, "had something" when he said, "If you get in a rut and can't get out, improve the rut." We undertook the task, believing that it could be done, and realizing, of course, that many changes and adjustments would be necessary during the 5-year period.

It was necessary for agronomists and engineers to prepare educational material outlining recommended conservation practices that could be used to meet the conservation requirements under the plan. At the close of the State school the technical and administrative personnel were divided into three teams who conducted the district schools. Each team included an engineer and an agronomist, one of them from the Extension Service and the other from the Soil Conservation Service. These men discussed the technical phases of the program and conducted field tours. In addition to observations of established conservation practices in the field, a well-selected set of slides was used to illustrate further the conservation practices necessary to qualify for full payment under the AAA program.

Educational authorities tell us that the most effective method of teaching is through the eye. Meeting

Seed patch of blue lupine, a promising winter legume in parts of the lower South.

places for the district schools were thus selected so that farms with established conservation programs could be visited. The field trip provided an opportunity to bring administrative personnel and farmers alike into direct contact with the conservation problem on the land. After all, it is hard to administer a program if you do not know what the end product should be.

The enthusiasm with which the farmer-committeemen participated in the discussion along with their wholehearted approval of the plan was enough to convince anyone that they meant business. These farmers expressed the need for a planned conservation program and one committeeman said, "I don't know much, but what I know, I know as well as anyone." When asked what he knew he replied, "I know that this program should have been started 5 years ago."

Those who attended the district schools are responsible for teaching local leaders or community committeemen how to assist farmers in filling out their work sheets, showing what the 5-year and 1941 goals are and how these goals are to be reached. They also assist farmers in making an inventory of the practices already established on the farm. Judging from the group I saw in action in Pike County, the responsibility has been assumed and they are determined to do something about their problems on the land.

Throughout the planning, it was brought out that the requirements of the AAA program are not unreasonable, since the farmers who have signed soil conservation district agreements have obligated themselves to establish practices equivalent to more than twice the requirements set up by the AAA.

The farms planned by the Soil Conservation Service on which conservation practices were established have been of inestimable value in the educational program. These farms have made a tremendous contribution as stepping stones in a mass attack on soil conservation problems. They are patterns which guide community committeemen in assisting farmers to make foundation plans for their farms and to establish some of the fundamental conservation measures. In the main, these fundamental conservation measures are the permanent fixtures around which complete farm conservation programs will be developed. As to the job itself, it is evident that the old song, "when the work's all done next fall," has little application in this plan. A trained survey crew is needed for each community in the State to help do the terracing, and a large volume of planting material will be necessary before the vegetative program becomes a reality. Furthermore, schools had to be conducted to teach young farmers how to plan water-disposal systems. Other schools were conducted to show agricultural workers and farmers how to dig, grade, and handle kudzu crowns.

This program will require 50,000,000 or more kudzu plants annually during the 5 years. No such volume is available from commercial sources and it therefore has been necessary to mobilize in an orderly manner the planting material from all sources. Each county group assumed the responsibility of making

Beef cattle grazing on permanent pasture of white Dutch clover, Dallis grass, annual lespedeza, and Bermuda grass.

available a supply of planting material for use by the farmers of the county. As a result of this agreement the AAA through the conservation-materials project has furnished 18,000,000 kudzu crowns, and the farmers have secured a like amount from local sources. Many of these crowns were dug from plantings made by the Soil Conservation Service on project and camp areas. In addition, the Soil Conservation Service through the district program has provided 8,000,000 kudzu plants to cooperating farmers in Alabama.

On the other hand, in spite of the efforts of the State agronomy committee and others, the available supply of seed and other planting material was only a fraction of the needs. The Alabama farmers would have used the entire national supply of *Lespedeza sericea*, common and Kobe lespedeza, Dallis grass and white Dutch clover seed, had they been able to obtain it at a reasonable price.

It has been interesting to watch the program develop. One of the most striking changes is in the way of thinking of agricultural workers. Most of us in the beginning had little conception of the time, skill and material necessary to execute such a large-scale action program.

It is significant to note that this plan is forcing those of us who have responsibility for its success to size up the entire job that is ahead. The enormity of the task of the future allows little time for "crowing" over past accomplishments.

FSA CLIENTS BECOME CONSERVATION FARMERS

County rural rehabilitation supervisors in Ohio have become proficient at laying out contour strips, and in planning other erosion control practices, as a result of close cooperation between the Farm Security Administration and the Soil Conservation Service. The Farm Security Administration teaches its clients that to rehabilitate farm families it is usually necessary first to rehabilitate farm lands. A series of 1- and 2-day schools, sponsored by FSA and with the active participation of SCS technicians, served as the springboard for this cooperation.

FSA supervisors went into the field and obtained first-hand information on conservation planning. Now they take their clients to the field, instruct them in observing erosion and studying ways to check it. With these practical eduational steps as a prelude, FSA is insisting more and more that conservation practices be established wherever possible on all client farms.—R. R. Barker.

THIS FARMER PLANS AND WORKS

By L. A. WILKINS [1]

IN MISSISSIPPI the old timers thought of grass as something to be fought from dawn to dark during the crop season, but E. N. Nolen, farmer near Coffeeville, is cultivating grass and making it work for rather than against him.

When he sought the assistance of SCS-CCC camp technicians in working out a conservation plan for his severely eroded 240-acre farm, Mr. Nolen knew that he needed feed for his cattle. This was early in 1936. The house he lived in was in need of repair—part of it had a dirt floor—but he knew that his most urgent need was feed for his dairy cows and that a new floor for his house could come later. He spent money for fertilizer for use in establishing perennial forage, knowing that his small herd of dairy cows, if well fed, would pay for the remodeling of the house. The neat rock-veneer home shown on this page represents the fruits of the toil and sacrifice of a farmer and his family who knew what they wanted and were willing to work and plan for it.

In planning his land use, Mr. Nolen did not hesitate to convert cultivated cropland to pasture and perennial forage. He reduced his cropland acreage 21 percent, and increased acreage of pasture 28 percent. He planted 21 acres of kudzu, and also 5 acres of *Lespedeza sericea*, which will be further increased with 250 pounds of seed harvested in the fall of 1940.

[1] District conservationist, Southeastern Region, Soil Conservation Service, Winona, Miss.

E. N. Nolen examining the stand of kudzu that has just been fertilized and disked at the beginning of its third growing season. He harvested 21 tons of hay from 10 acres of kudzu in 1940.

Increased returns from dairy cows as a result of more pasture and home-grown feed financed the remodeling of the Nolen home.

Although woodland acreage had to be reduced by 25 percent to make room for the pasture and perennial forage needed on the farm, Mr. Nolen hopes for an increase in his timber income because he has excluded livestock from his remaining woodland and he is using other improved management practices provided in his farm plan.

This farmer's program is beginning to bear fruit: His average annual income from milk and cattle sold during the 3-year period, 1938–40, was $66.07 more than in the 3-year period, 1935–37. This increase was the result largely of improved grazing in pastures. Likewise, the returns from perennial forage crops are beginning to be a factor in his income: Of the 1937 planting of kudzu, 8 acres yielded 8 tons of hay in 1939, and 21 tons were harvested from 10 acres in 1940.

As a result of improved cropping systems in which legumes were grown, the average yield of corn was 500 bushels on 38 acres during the last 3 years, as compared with an average of 450 bushels on 47 acres during the 3 years, 1935–37.

Mr. Nolen has done an outstanding job under unusual difficulties. He started with a very poor farm and with little financial resources, and already he has achieved a degree of success that in the beginning did not appear possible.

TIMELY ARTICLE

"In the last war we plowed more and wasted much. Now, we will plow less, yet grow more." Thus writes F. E. Charles for the August issue of this magazine.

CONSERVATION FARMING ON A COTTON AND TOBACCO FARM

By W. C. EAGLES[1]

TO MY knowledge this North Carolina farmer has not built any unusual mousetraps, yet the world is beating a path to his door—to study the secret of his success in making better use of his 101-acre tobacco and cotton farm. The farmer is H. B. Cooke, of Franklin County.

In 1936, when technicians of the Franklinton project of the Soil Conservation Service began helping him to develop a conservation plan on his farm, Mr. Cooke had 40 acres of cropland, 11 acres of idle land, and 50 acres of woodland. He had been growing a small acreage of oats which he cut for hay, while he depended largely upon corn fodder for forage. The corn fodder was pulled by hand. Approximately one week of man labor was spent for each ton of forage obtained.

His land was not terraced, and he did not follow any systematic rotations. His pasture consisted of 2½ acres covered with a partial stand of second-growth pines and broomsedge. As a result of his farming practices, the soil of his farm was being washed away and acre yields of crops were low.

Today, after less than 5 years of soil conservation farming, all of Mr. Cooke's land is in use. He is following a systematic rotation under which at least half the cropland is kept under protective vegetative cover. He grows 12 acres of lespedeza in his rotation. Approximately two-thirds of his lespedeza is combined for seed, and the remainder is harvested for hay. He combines from 5 to 8½ acres of grain, thus leaving the straw on the land instead of removing it for hay as he did formerly.

Largely as a result of the lespedeza straw that is turned under, his acre yield of seed cotton has been increased from 700 to 900 pounds and the yield of corn from 16 to 30 bushels an acre. By almost doubling his acre yields he is now producing slightly more corn on 6 acres than on 11 acres before the plan was developed.

Since bright tobacco does not fit into a rotation with legumes, Mr. Cooke is growing his in a rotation with rye which he harvests for seed. His acre yields of tobacco have increased to such an extent that the total yield is only slightly reduced by an allotment cut from 8 to 5.6 acres under the AAA program.

Whereas no systematic effort was made to control erosion before the conservation plan was written,

[1] Assistant soil conservationist, Upper Cape Fear Soil Conservation District, N. C.

Lespedeza sericea is giving effective protection in this waterway on the Cooke farm.

Mr. Cooke gets a large part of his hay from this meadow strip outlet which safely disposes of water from terraces on the adjoining sloping fields.

Mr. Cooke now has all of his cropland terraced and his rotation arranged in strips on the contour for more effective erosion control. Proper terracing, and contour tillage with improved row arrangement and with the protective vegetation in the rotation arranged in strips at intervals to break the slope, have greatly reduced the loss of soil and water from his cultivated land.

As a part of his water-disposal system, Mr. Cooke has established a 3-acre meadow outlet in which grasses and legumes were planted in a mixture. In addition to providing safe water disposal from terraces, this meadow outlet produces a large part of the hay for the two work animals and one milk cow kept on the farm.

In place of the 2½ acres of low-grade pasture that he had before the plan was put into effect, Mr. Cooke now has 5 acres of improved pasture that produces approximately 40 percent of the feed for the livestock kept on the farm. Furthermore, this farmer is now producing approximately the same amount of corn, and only slightly less cotton and tobacco, than he did prior to planning. He is doing this on 8.4 acres less land. The land that has been taken from row crops is being utilized for small grain and other crops, principally lespedeza.

Income on this farm has been considerably increased through the following: production of the wheat needed on the farm; the sale of approximately $50 worth of poultry products, 75 to 100 pounds of butter, 60 bushels of sweet potatoes, 1,000 pounds of lespedeza seed, an average of 7 pigs, $30 worth of meat, and a small amount of corn and small grain each year.

He is making a larger income and is improving rather than depleting his soil resources. Although this farmer lives at the end of a narrow, unimproved road approximately one-half mile from the main highway, hundreds of visitors come to see the results of the outstanding job he has done on his family sized farm.

OTHER AGENCIES ASSISTED

The following quotation is taken from the last semi-annual report of the supervisors of the McIntosh Soil Conservation District, Oklahoma:

> "The NYA furnished the district with 108 man-days of labor, and these people were used to assist the planning technicians on the district staff. * * * The WPA worked an average of 60 men on 63 district farms. For the most part they were used in planting trees and grass, controlling gullies, assisting in pond construction, pasture clearing, and stabilizing terrace outlets. During that time 4,102 man-days of labor were used on these and similar jobs."

BUILDING A SOD DEFENSE

C. R. Enlow begins his next month's article: "Our boys need to be conditioned for defense. So does our soil."

INDIANA DISTRICT PLANS FARMS BY WATERSHEDS

By F. E. CHARLES [1]

IN ADDITION to the customary single-farm plans, the Knox County Soil Conservation District in Indiana is taking applications on a small-watershed basis, with the aim of solving both erosion control and drainage problems.

Under the watershed plan, district supervisors require all landowners with property adjacent to the drainage ditch to sign the application. The application also gives right-of-way for a drainage survey. When the owners sign, they are told that they will be expected to consider erosion control as a part of the project, because erosion on the upland will cause siltation and destruction of the drainage ditch.

A conservation survey is conducted at the time of, or before, the drainage survey, and land-use capability maps are prepared for the entire watershed.

"After a preliminary drainage survey has been conducted a group meeting is held," Lester H. Binnie, district conservationist, explained. "Both drainage and erosion control are discussed. Thus far it has been possible to complete erosion control plans for most farms, and in some instances to put them into effect, before drainage has been accomplished. The supervisors do not expect 100-percent agreements on erosion control—although in the first watershed, about 1,200 acres, all the landowners are cooperating in erosion control. In this instance eight farms are involved."

Ten applications of this type have been received, the number of land owners involved ranging from 6 to more than 50 per watershed. Of the first 50 farm agreements, about half were on the watershed basis. Cooperation is being obtained from the State and County Highway Commissions and from a railway company.

The common problem, drainage, is an asset to completion of farm planning for erosion control, Mr. Binnie finds. It facilitates group education and action. Two or three group meetings are held in a watershed

(Continued on p. 28)

[1] Chief, regional information division, Ohio Valley Region, Soil Conservation Service, Dayton, Ohio.

The common soil types are particularly susceptible to erosion. Soil washes easily, leaving raw areas like this.

GRASS SILAGE AND SOIL CONSERVATION

By GROVER F. BROWN [1]

THE term "grass silage" is generally used to refer to silage made of any green feed that can be used for hay. We often speak of grass silage as including not only grass but legumes, or a mixture of grasses and legumes; sometimes small grains are included, or even pasture surpluses that can be mowed and put into the silo for later feeding. The preservation of grass by placing it in vertical or trench-type silos is not new, but it is only recently that its importance has been recognized in this country. Intensive study is now being carried out to determine the best method of preserving forage. Yields and the quality of feed produced by different grasses and legumes are also under scrutiny. A dense growth of grasses and legumes has long been recognized as the natural method for conserving and building better soils, and those interested in soil conservation look to grass silage with a great deal of confidence.

Methods.—At least four different methods for making grass silage are used in this country at the present time. All have their peculiar characteristics. These four general methods are usually known as (1) ensiling without any preservative, (2) the A. I. V. method, (3) the phosphoric-acid method, and (4) the molasses method. The last-named method probably is used much more extensively than the other three in the United States.

In preserving grasses and legumes without the addition of acids or carbohydrates, careful attention must be given to the moisture content of the material at the time of ensiling. About 65-percent water appears to be the optimum moisture content for this purpose. It is very difficult for the practical farmer to obtain this optimum, especially under varying acreage and weather conditions. Spoiled silage results oftener from this method than from others involving the addition of some kind of preservative. In making good silage without any preservative, it is necessary that the hay be allowed to lie in the swath and wilt for 2 to 4 hours after cutting on a good drying day, and longer on a poor drying day. The material must be chopped fine. In filling the silo the silage must be kept leveled and must be well tramped to expel the air. Partial drying of the hay in the field diminishes losses caused by fermentation, and the resulting silage usually has a good odor; on the other hand, it is claimed that the surface spoilage and loss of carotene are increased by this method.

Harvesting grass silage. (Photo courtesy of D. B. Johnstone-Wallace, Cornell University.)

The second or A. I. V. method, calls for the addition of about 12 to 18 gallons double normal solution of five parts hydrochloric acid and one part sulphuric acid to each ton of green material. The cost for the acid usually is from 90 cents to $1.20 per ton of silage. In feeding this silage, about 1 ounce of limestone is fed with each 15 to 20 pounds of silage to offset the acidity. It is claimed that this method of ensiling conserves most of the carotene content of the green feed.

In the phosphoric acid method, third on the list, phosphoric acid is used at about the rate of 1¼ gallons (16 pounds) to each ton of green material. One advantage claimed for this method is that any phosphoric acid not assimilated by the digestive processes of the animal passes on to the manure to increase its phosphorus content. If a cow eats about 40 pounds of silage a day, it is claimed that her manure contains an amount of phosphorus about equal to that in a pound of superphosphate sprinkled in the gutter. The cost of phosphoric acid is 55 to 60 cents a gallon, making the cost per ton of green material ensiled about 70 to 75 cents.

The molasses method of ensiling is widely used. It calls for the addition of 40 to 90 pounds of blackstrap molasses to each ton of green material ensiled, depending on the relative proportions of grasses to legumes in the mixture. Usually the molasses is fed into the ensilage either at the bottom of the blower on the chopper or at the top of the spout that dumps the material into the silo. Sometimes it is sprinkled on the silage in the silo with a can. Since molasses is a concentrated source of carbohydrates, it furnishes material for active fermentation similar to that which takes place in corn silage. This fermentation results

[1] Chief, regional agronomy division, Northeastern Region, Soil Conservation Service, Upper Darby, Pa.

in the formation of acids which act as preservatives. The cost for molasses usually runs about a cent per pound in barrels, depending on the freight rates.

Feeding Qualities.—Most experiments show that silage made from good materials and properly ensiled by any of the four major methods is of high quality. Some experiments tend to indicate that one method is superior in some respects to the others, but it appears that any of them, if used properly, will produce good feed. The final selection of the method is largely a matter of personal opinion, costs, and the equipment and materials available. It has been pointed out by the Wisconsin Agricultural Experiment Station that there is a beneficial effect from the plant juices in grass silage that is lost when the material is cured as hay.

One of the most important claims made for the feeding of good quality grass silage is its effect upon the carotene content of the milk and improvement in color and flavor. In fact claims are made that alfalfa molasses silage is almost equal to spring pasture in putting yellow color in milk and is equal to or better than pasture in producing milk of fine flavor and high resistance to the development of oxidized flavor. The market milk handlers in parts of the New York market are urging their grade "A" producers especially to feed grass silage during the winter months to maintain the summer quality of the milk.

Reports from the various experiment stations and practical dairymen are not in agreement regarding the palatability of silage made from the different methods. Some reports show that phosphoric acid silage is less palatable than molasses silage, while others indicate a higher milk color and carotene content in silage preserved with phosphoric acid. A survey of the work being done at the various experiment stations gives the impression that the quality and feeding value of the silage depends more on the quality and feeding value of the product at the time of ensiling, plus the care used in the ensiling process, than upon the method or preservative used.

In most of the feeding trials, good legume or alfalfa silage has been fed at the rate of 3 to 4 pounds, and hay 1 pound, per hundred pounds of liveweight. It is the opinion of most feeders that the grain ration may be cut to at least 12 percent when alfalfa silage is being fed. On farms where good alfalfa or other legume silage is raised, this may materially lower the cost of milk production.

Cost Factors.—The cost of producing grass silage, as compared with corn silage, is very largely determined by the equipment available for handling the material on any particular farm. A great deal of hard labor is involved in handling green material for grass silage unless proper machinery is used. However, anyone who all day long has wrestled heavy green corn bundles on the wagon and through the cutter will appreciate that this job itself has its tiring moments. Furthermore, equipment for easier handling of green material for ensiling is now on the market, and it reduces the physical labor to the point of equality with corn silage. One machine, used quite extensively in the northeastern States last summer, cut the green hay, chopped it into short lengths suitable for ensiling, and elevated it into a wagon or truck ready for delivery to the silo. There it was run through the regulation blower, where the preservative was added, or else run into the silo by an inexpensive elevator powered by a two-horse motor. The same elevator was used for removing the material from the silo, a job not easy in itself in winter when the silage is frozen.

The new portable grass chopper patterned after the small combine will doubtless increase use of grass silage as a method of preserving winter and supplementary feeds. Some of the older hay loaders are not sufficiently strong to handle the green weight. New equipment, designed especially for this heavier work, will come into use as the old equipment wears out.

Some detailed cost figures kept at the Massachusetts Experiment Station show the following costs per ton of grass silage:

Fertilizer and manure	$0.82
Seed	.12
Labor in preparing and seeding the land	1.04
Labor in harvesting and filling the silo	2.37
Molasses	.78
Total cost per ton	5.13

Any comparison of production costs for grass silage and corn must take into account the amount of feed nutrients per acre. Year in and year out, good corn land properly handled yields somewhat more silage than the same land in hay. However, not all land that is producing corn is good corn land. On such land the total yield of food nutrients may be less than the amount produced by a mixture of grasses and legumes. In most experimental results, corn outyields the other crops in production of total digestible nutrients per acre, but the yield of protein per acre is much higher in the case of the legumes, especially good alfalfa.

Nearly every dairy farm can increase its hay yields. Therefore, since protein is the most expensive part of the ration, and since the cost of planting and cultivating is considerably less with grass than with corn,

Filling a silo. (*Photo courtesy of C. B. Bender, New Jersey Agricultural Experiment Station.*)

it is clear that the use of grasses and legumes for silage compares quite favorably with the use of corn. There is one factor, however, that should be given consideration in making this comparison—the relative resistance to summer drought of corn and the second cutting of hay. Unless irrigation is available, summer drought is usually more serious to the hay and pasture crops than to the corn; thus, if a dairyman is depending entirely on grass silage he may be caught napping unless he carries reserves of feed over from one year to the next.

The Illinois Experiment Station has attempted to place a value on grass silage. Many farmers, and others, have tried to figure a value on the basis of production costs, but this is an elusive figure to obtain. The Illinois station has based its valuation of grass silage on the current market value of grain and hay. This represents the actual cost of replacing the silage with feed value equivalents. To compute the value on a ton basis, the value of 4.6 bushels of corn is added to the value of 270 pounds of mixed hay; this gives a value compensating for the seasonal fluctuation in the value of feeds and hay.

Most of the experiments on the feeding of grass silage have been concerned with dairy cattle. This is only natural in view of the returns especially if returns are through market milk from dairy cattle as compared with beef, horses, or poultry. Most of the evidence favoring grass silage over corn deals with such items as increasing the carotene content of milk, making for better color, decreasing the amount of odors from oxidation, and maintaining a more uniform flow of milk the year around. Grass silage seems to have more importance in quantity and quality of milk than in the amount of flesh laid on animals.

On the other hand, at Cornell, dry, beef-breeding cows fed phosphoric acid silage were maintained quite satisfactorily, while tests run at the New Jersey Experiment Station showed the same results from feeding Sudan grass molasses silage. The animals came through the winter in good breeding condition and dropped strong calves. At the latter station the same results were experienced with breeding ewes, except that the ewes had to be fed a small amount of protein supplement just before lambing. Twelve horses were wintered over in satisfactory condition on molasses oat silage alone at the New Jersey station. Some of them were mares in foal. The men making the tests encountered less digestive troubles with the horses than at any time during the preceding 6 years.

Considerable interest has been shown during the last few years in the use of grass silage for poultry. Good grass silage is greatly relished by poultry and supplies the same important need in their winter diet as in that of other classes of livestock. Fifty-gallon buttermilk barrels make very good containers for putting up silage for poultry. The grass may be clipped with an ordinary lawn mower, put into the barrel, and firmly tamped down as the barrel is filled.

In filling a barrel of this size, about 4 gallons of molasses mixed in an equal amount of water should be added either while the barrel is being filled or after it is entirely filled. The barrel head should be put on as soon as the barrel is filled and weighted down so that there is a pressure of about 200 pounds on the ensilage. When the barrel is opened for feeding, the layer of mold which usually forms on the top should be scooped off before the silage is placed in the feeding pans.

Farm Building for Grass Silage.—More extensive use of grass silage naturally calls for a change in the design of barns and hay storage buildings. The large dairy barn has been a standard of prosperity for many years, and the more hay it could hold the better the barn. Yet silos can provide the necessary storage space at about the same cost per cubic foot as a conventional haymow, and each cubic foot stores over three times as much feed. When more farmers begin to store grass and hay in silos the need for the big hay barn will pass, and with it many of the dangers connected with fire and wind hazards. The annual barn loss from wind and fire is estimated at about 150 million dollars. Twenty percent of the loss suffered by farmers through barn fires is due to spontaneous combustion in stored hay. Good grass silage, because of its high water content, will not burn by spontaneous combustion.

Much trouble has come about through storing grass silage in an old corn silo. A silo that can withstand the pressure of grass silage must be considerably stronger than one built only for the storage of corn silage. It must also be tighter to prevent leakage of juices from the bottom portions, as leakage not only results in loss of food nutrients but contributes to sanitary problems as well. A silo full of grass silage as it is usually made weighs more than the same silo filled with corn and lateral pressure is therefore greater. If the older corn silo is used it becomes necessary to reinforce the lower third to prevent bulging.

Farmers using grass silage have had some difficulty from the action of the silage acids on the walls of their silos. If kept in good repair, a silo constructed of creosoted wood staves, galvanized sheet metal, clay tile, and other newer materials gives satisfactory service. The durability of a silo made from almost any material can be increased by a protective coating such as asphalt paint, cement wash, boiled linseed oil, and others. Silo manufacturers are alive to this problem; many experimental silos have been built in efforts to determine the best materials for walls and for cementing the parts together. Some of the materials are said to be resistant to all forms of acids developed by silage, and thus we may expect that this problem will pass out of the picture along with the difficulties now being experienced with old machinery.

Grass Silage and Soil Conservation Planning.—The farm planner is repeatedly faced with the problem of making a decision as to whether or not he should advise a soil conserving crop for land being used for soil depleting crops. The removal of crops from lands too steep to support them safely would be a big step in the direction of soil and moisture conservation. However, when a farmer has been accustomed to raising a certain acreage of corn each year and has built his dairy or livestock industry to match his crop, it is difficult for him to change his way of thinking. Such a change is no small part of the planner's job since he must work, without ceasing, toward getting some form of permanent vegetation on critically eroding fields and he must realize at the same time that such land-use changes must fit into the farming set-up.

By and large, grass is more permanent and more dependable year in and year out than are the cultivated crops. Weather is a difficult problem for all farmers, and any method of crop production that is somewhat independent of the vicissitudes of weather should be utilized to the utmost.

In this short summary of the data available on grass silage, I have not tried to tabulate all the advantages and disadvantages in the utilization of feed in this form. The main thing which a farm planner should remember is that sufficient experimental work has been done with the ensiling of green material to place the methods on a sound and economical basis. He should therefore avail himself of all the data locally available on the subject. A great number of farms needing a soil conservation plan are operated by farmers whose resources are extremely limited; usually, they do not have on hand the information available at their State experiment station. This small farmer almost always needs land adjustment more than the more well-to-do farmer who is in constant touch with the recommendations of his extension service representative. No farm is too small for its owner to pass up the possibilities of green silage for his livestock. He can preserve it in any type of container ranging from a good tight barrel or a trench silo to a $2,000 upright silo.

INVESTMENT IN YOUTH

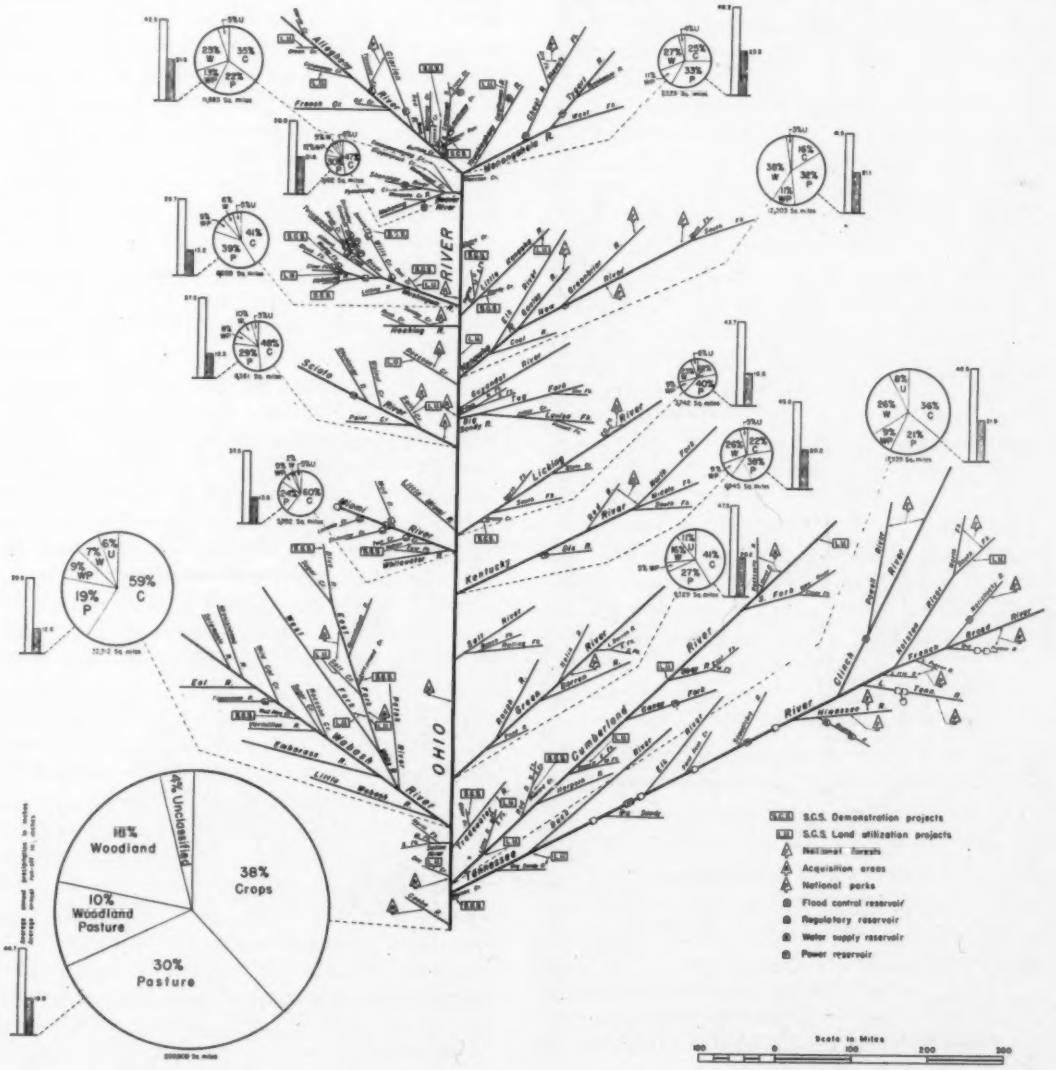
In August, G. H. Gilbertson tells of the CCC: "Today the Nation can look forward to receiving a big return from its investment in youth—and sturdy, able young men are perhaps the most important of her defense assets."

GRAPHIC PRESENTATION OF LAND USE AND HYDROLOGIC DATA

By C. S. JARVIS and H. C. MURTO [1]

A VAST amount of basic data relating to land use and hydrology in the various regions of the United States has been collected and analyzed within the past 5 years by the Soil Conservation Service. Along with the work of collection and analysis we have recognized the need for a method of graphic presentation that will appeal to the user of the information and at the same time point out the items and

[1] The authors are hydraulic engineer and assistant hydraulic engineer, respectively, project plans and survey division, Soil Conservation Service, Washington, D. C.



SCHEMATIC DRAWING OF THE OHIO RIVER SYSTEM SHOWING LENGTHS AND RELATIVE POSITIONS OF STREAMS, DRAINAGE AREAS, AND LAND USE; LOCATIONS OF GOVERNMENTAL CONSERVATION PROJECTS, MAJOR REGULATING RESERVOIRS, AND BASIC HYDROLOGIC DATA.

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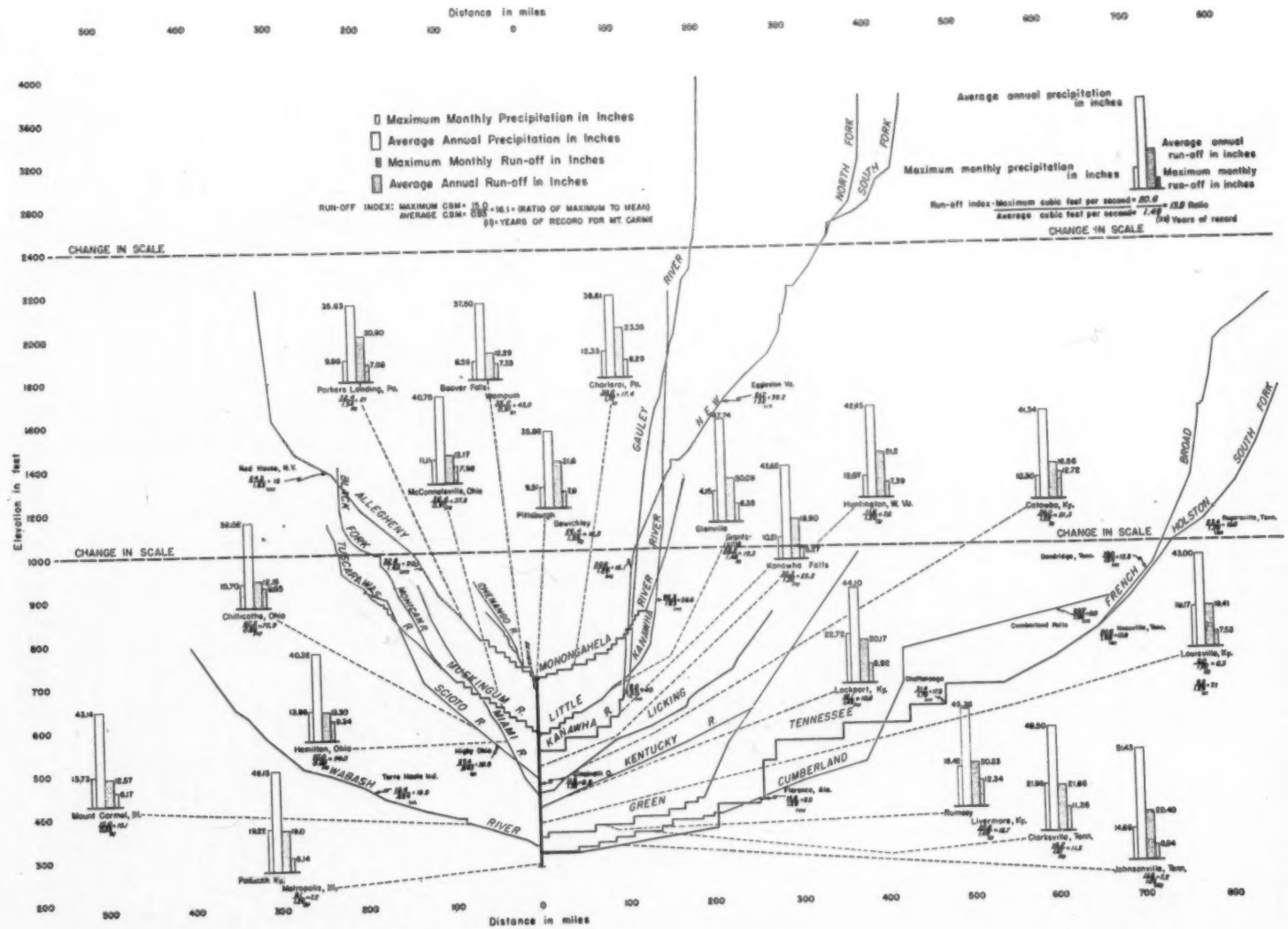
Distance in miles
Elevation in feet
Maximum Monthly Precipitation in Inches
Average Annual Precipitation in Inches
Maximum Monthly Run-off in Inches
Average Annual Run-off in Inches
RUN-OFF INDEX: MAXIMUM CSM= 15.0 / AVERAGE CSM= 0.93 = 16.1 = (RATIO OF MAXIMUM TO MEAN)
80= YEARS OF RECORD FOR MT. CARMEL
Average annual precipitation in inches
Maximum monthly precipitation in inches
Average annual run-off in inches
Maximum monthly run-off in inches
Run-off index = Maximum cubic feet per second = 80.6 / Average cubic feet per second = 1.49 = 13.8 Ratio (30 Years of record)
CHANGE IN SCALE
CHANGE IN SCALE
CHANGE IN SCALE
NORTH FORK
SOUTH FORK
GAULEY RIVER
N. F. NEW RIVER
BLACK ALLEGHENY
TUSCARAWAS
MUSKINGUM R.
SHENANGO R.
MONONGAHELA
KANAWHA RIVER
BIG SKIOTO R.
SCIOTO R.
MIAMI R.
LITTLE KANAWHA R.
LICKING
KENTUCKY R
TENNESSEE
CUMBERLAND
GREEN
WABASH RIVER
BROAD
SOUTH FORK HOLSTON
FRENCH BROAD
Parkers Landing, Pa.
Beaver Falls
Charleroi, Pa.
McConnelsville, Ohio
Pittsburgh
Glenville
Kanawha Falls
Huntington, W. Va.
Chillicothe, Ohio
Hamilton, Ohio
Lockport, Ky.
Louisville, Ky.
Mount Carmel, Ill.
Paducah Ky.
Metropolis, Ill.
Rumsey
Livermore, Ky.
Clarksville, Tenn.
Johnsonville, Tenn.

the significance of their relationships in a manner to render them most convenient for reference. The schematic drawing and tree graph of the Ohio River system, shown in figures 1 and 2, illustrate some of the recent approaches to a solution of this problem. A brief discussion of these charts and how to use them is given in the following:

When information is wanted regarding the location and sequence of tributaries, their subdrainages from headwaters to junctions with the main stream, and locations of projects under various governmental and public utility agencies, then the schematic drawing, figure 1, is to be used. It shows also, in circular diagrams, the relative extent of drainage areas and the proportions of them in crop land, pasture, woodland pasture, woodland, and unclassified, for each of the major tributaries, as well as for the main river basin. For example, the percentages of cultivated land on the Miami, Wabash, and Kentucky Rivers are 60, 59, and 22 percent, respectively, while the corresponding percentages of pasture areas are 24, 19, and 38.

Associated with these circular diagrams showing land-use percentages are vertical bar diagrams showing respectively the average annual precipitation and run-off at corresponding stations, ordinarily about 40 inches per year for rainfall and from one-third to one-half this amount for depth of average annual run-off.

The tree graph is to be used when the desired information has to do with the relative slopes of stream channels, as well as the distance in miles above their junctions with the main river. In figure 2, the tree graph, it may be seen that the Tennessee River system extends more than 800 miles from its junction with the Ohio River and that it rises in elevation more than 300 feet within the navigable reach extending nearly 500 miles to Chattanooga. Similarly, the dams and navigation locks of other main tributaries are shown in their relative positions. The bar diagrams of hydrologic data show for each station not only the average annual precipitation and run-off depth in inches, as included in figure 1, but likewise corresponding depths for maximum monthly records. Furthermore, additional indices are supplied in the form of the fraction and quotient for each principal station wherein the numerator represents the maximum or flood yield in c. s. m. (cubic feet per second per square mile), while the denominator is the average for the period of record, shown as a subscript, and the quotient is the ratio of maximum to average yield. Thus, for Metropolis, Ill., Louisville, Ky., and Huntington, W. Va., the quotients are 7.2, 7.1, and 7.6, respectively, showing how consistently the maximum flood yields of record have been approximately seven times the average discharge of the stream.

Among the tributaries the quotient is normally much greater; thus, for the Allegheny at Parkers Landing, Pa., it is 21.0, for the Wabash at Terre Haute, Ind., 19.9, and for Mount Carmel, Ill., 16.1.

Taken in conjunction with the data on slopes supplied in part by the profiles of tributary channels, shown much more in detail on topographic maps, and when considering the influence of land use and prevailing vegetal cover on run-off phenomena, the data on these drawings furnish valuable clues regarding flood magnitudes against which provision should be made.

Similar drawings have been prepared for the entire Mississippi River system in the course of assembling material for a U. S. Department of Agriculture bulletin to be entitled "Graphic Interpretation of Hydrologic Data as Related to Land Use." Naturally, much greater variation is shown within the Mississippi River basin than prevails in the Ohio basin where both the precipitation and run-off are more nearly equably distributed than for any other major tributary. Furthermore, the Ohio River yields nearly one-half of the lower Mississippi River discharge, from approximately one-sixth of the total drainage area; while the Missouri River yields more nearly one-tenth of the total discharge from nearly one-half of the total drainage area. However, among the headwaters in high mountainous regions, the Missouri and the Arkansas River tributaries have recorded yields more nearly approaching those of the Ohio Valley, expressed in c. s. m.; while the Great Plains areas show but meager unit-yields, both for maximum floods and for average discharge.

EQUIPMENT MAINTAINED

The following quotation is taken from the last semiannual report of the Bogue Chitto-Pearl River Soil Conservation District, Louisiana:

> "The Police Juries of the parishes within the District are cooperating to the extent of furnishing funds for the maintenance of equipment loaned the district by the Soil Conservation Service."

Note: Parish police juries are comparable to County Commissioners in many other States.

CARTOGRAPHY AND DEFENSE

"The fastest system of making maps of good accuracy from aerial photographs" is described in an early issue of Soil Conservation by Harry T. Kelsh.

CONSERVATION PLANNING FOR SMALL FARMS

By T. J. CAULEY [1]

IT IS becoming increasingly apparent that the Soil Conservation Service must develop a definite policy with respect to the problem presented by small farms in areas of relatively poor land. The problem consists in the fact that these small farms in many instances include a comparatively large percentage of land that must be retired from cultivation and planted to grass or trees in order to halt erosion effectively. The result of this dilemma, on the typical farm of this class, is that after such retirement the farmer has so little cultivable land left as to constitute what is usually referred to as an uneconomic unit.

The question immediately arises as to how small a farm unit must be in order to be classified as uneconomic. This question brings up the further question of how best to measure the size of a farm. The most common measurement, of course, is the number of acres it contains, but this is not always the most significant figure from the standpoint of the economy of its operation. From an economic standpoint the size of a farm should be measured in terms of its net income, although, naturally, the number of acres is one factor that influences the amount of net income. On the other hand, it is by no means the only factor to be considered.

Granting that the size of farms should be measured in terms of net income, how small can this income be without becoming "uneconomic"? Obviously, no final, definite, universally applicable answer to this question can be found. To put it concretely, can a farmer afford to continue to operate a farm which yields him a net income of only $400 a year? The answer depends largely on the alternatives open to him; and since such alternatives will vary widely with individual farmers and in different localities, the answer will vary accordingly.

As the problem exists in parts of Arkansas, Louisiana, Oklahoma, and Texas, large numbers of farmers are operating small farms with virtually no other economic opportunities available to them unless they are given help of some sort. Their net farm incomes, including both cash and subsistence, probably will not average more than $400 a year. What are we to do about them in the way of conservation of soil resources?

[1] Chief, division of economic surveys, Western Gulf Region, Soil Conservation Service, Fort Worth, Tex.

If Soil Conservation Service personnel plan a small farm for conservation purposes in such a way as to yield the farmer and his family less than enough for mere biological existence and the essential social services, the farmer will either refuse to sign an agreement including such a plan or sign it and within a short time be forced by economic pressure to violate it and resort to exploitative methods. In either case, the soil conservation program will have failed in its essential objective of saving the land for the peoples' sake.

Several possible approaches to this problem are open. Let us list them, and then examine each of them briefly by way of determining its merits and workability.

1. A farmer whose farm is too small may either buy or rent additional land in the neighborhood *if it is available.*
2. If additional land is not available, a sufficiently large number of farmers may be moved out of the locality to enable those who remain to have farms of adequate size.
3. A program of part-time farming and part-time nonfarm employment may be developed in the locality.
4. A more intensive type of farming may be developed on the adapted cropland, pastureland, and woodland which the farmer has and thus enable him to obtain an adequate income.

The possibility of the small farmer buying or renting enough land in his immediate vicinity to give him a unit of adequate size is strictly limited. Areas needing adjustments of this kind usually are areas of serious rural overpopulation. No surplus of land is available. What is bought or rented by one farmer in the effort to obtain an economically sized unit frequently is taken away from some other unit that needs it just as badly. No net gain is achieved in shifting land from one small operating unit to another. Obviously, however, in those comparatively rare instances where unoccupied land is available nearby, the purchase or lease of this land by the farmer is the simplest and best solution of his difficulty. The Farm Security Administration and the Farm Credit Administration can help in these instances.

The general method of moving enough farm families out of a locality to enable those left to have

farms of adequate size has been tried to a greater or lesser degree by the Resettlement Administration and its successors, one of which is the Land Utilization subprogram of the Soil Conservation Service as financed by "title III" funds. Undoubtedly, the method has potentialities and already has accomplished some good. For the present and the immediate future, however, the funds available for this type of adjustment are so limited in proportion to the need that the method is practically negligible in importance from the standpoint of meeting the problem adequately.

More fundamental perhaps than the lack of funds is the relative lack of any place to locate the farm families that are moved. No agricultural areas of appreciable size which are underpopulated from the standpoint of the farmers' ability to make money are at present available in the United States. On the contrary, the ability of American farmers, both collectively and individually, to make money would be greatly increased by a large net reduction in the number of farmers throughout the country. No good farming section in the Nation would welcome an influx of farmers from poor-land areas.

With respect to the possibility of shifting these people into urban occupations, it is clear that so long as we have millions of unemployed persons in our towns and cities this line of attack offers no real promise.

The third method listed above, that of providing part-time nonfarm employment to supplement the income from small farms, likewise has been tried by the Resettlement Administration and some other agencies. Thus far, it has had indifferent success. The decentralization of industry in the United States has been widely prophesied, but it is still a prediction rather than a fact.

One significant possibility of developing rural nonfarm work can be seen in many parts of Arkansas, Louisiana, and eastern Oklahoma and Texas, in the opportunity of combining farming and forestry to advantage. The forestry may be commercial in nature, it may be for the production of forest products for home use, or it may be a combinatior of the two.

A further possibility is the development by the Federal Government of a "rural works program" which would provide employment in conservation work for unemployed and underemployed rural people. Such a program would go a long way toward immediate relief of rural distress and at the same time help to conserve the basic resources of our agriculture, thereby removing one of the fundamental causes of rural distress.

We come now to the fourth possibility—more intensive utilization of what cropland the farmer has left after the application of the conservation plan to his farm, along with as intensive a use of pastureland and woodland as is consistent with conservation requirements. In almost all of the small farm areas in the Western Gulf Region, which includes all of Arkansas and Louisiana and most of Texas and Oklahoma, the prevailing type of farming has been cotton and corn. When the acreage of these crops is reduced, the farmer does not have the opportunity of making productive use of enough of his labor throughout the year to obtain an adequate farm income. It is possible that this difficulty may be offset by the production of more intensive crops and the development of more intensive livestock enterprises.

Some possibilities for diversified farming and supplementary income in such areas are listed in the following: the growing of truck crops; production of blackberries, grapes, and other small fruits; commercial orcharding, especially peach growing in parts of Arkansas and Texas; poultry production, dairying; intensive woodland management, yielding commercial forest products; the production of food, feed, and fuel for subsistence purposes. Obviously, not all of these are adapted to any one locality.

The chief difficulties involved in the intensive and diversified pattern of farming as against traditional cotton and corn farming are to be found in the inertia of the farmers, their lack of knowledge and skill with respect to the new enterprises, and the greater complexity of marketing the products of such a type of agriculture. These are very real difficulties and cannot be passed over lightly.

Furthermore, the general adoption of this pattern of farming would bring up the serious problem of the effect of increased production of such products upon the national and even the international supply and demand situation. As a nation, we are committed to a policy of restricting agricultural production to fit the effective demand therefor. Any shifting of land uses for conservation purposes should be harmonized with this broad objective.

When the lack of a proper pattern of land use and balance of enterprises stands in the way of application and maintenance of an adequate conservation program on a farm, it immediately becomes the function of the Soil Conservation Service to work out a satisfactory pattern of land use and balance of enterprises. The personnel of the Service should inform the farmer as to how much and what parts of his land can be safely

(*Continued on p. 28*)

BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neall Faris

AGRICULTURAL LAND-USE PLANNING IN THE TERRITORY OF HAWAII. By John Wesley Coulter. Agricultural Extension Service, University of Hawaii, Honolulu, 1940.

To the land-use planner, Hawaii is not merely the land of soft music and tropical radiance; it is a series of small areas, totaling considerably more than four million acres, separated by waters of the Pacific, with extremely diverse relief and climate, a growing and changing population and needs very similar to those on the mainland in spite of the isolation of the group. Dr. Coulter's intimate and sympathetic account of the people of the islands, their homes and work, their ambitions and opportunity, and their loyalties and pride in the development of their economic and industrial life, is one of the most illuminating to be found anywhere. A chart showing racial population of the islands throughout the 1853–1939 period indicates assimilation to the point of homogeneity within the not distant future, and this trend may prove to be extremely important in the development of land use in all the islands.

Geologists go, or want to go, to Hawaii to see the parent rock of the far distant future in the making; the land of the islands is relatively youthful, and drastic rapid changes in formation and physical composition are common occurrences. But, more practical and of much interest to conservationists, is the fact that recent detailed surveys of some of Hawaii's pineapple fields, pastures, and vegetable and fruit lands indicate that there is beyond a doubt a present-day erosion and land-use problem of considerable importance in the Mid-Pacific island group.

Dr. Coulter gives an excellent analysis of the agricultural industries of the islands, not only types, areas and planning involved, but field methods and labor conditions as well. Sugarcane is of course the major crop, and 30 percent of the people of Hawaii live on sugar plantations, while many others depend upon this highly specialized business for livelihood. Pineapple production comes next in importance, and it is interesting to note that growers are beginning to use soil conservation methods that will protect and improve the land and at the same time permit use of some areas for a more diversified farming.

In a final section, Dr. Coulter discusses at length the chances for diversified farming in these Pacific Islands and points out the several conditions now standing in the way of the small farmers who would like to own land and practice agriculture as a way of life rather than as a commercial enterprise. The need for soil conservation education is emphasized, also for land tenure studies and a regional approach to the land-use planning problem. It is of very great importance, in the author's opinion, that land-use planning for the Territory of Hawaii should include ways and means of providing food supplies commensurate with the use of the islands for strategic purposes.

DISTRICT PLANS BY WATERSHEDS

(*Continued from p. 18*)

and farm plans then are developed to fit the watershed as well as the farm.

Drainage plans supplied by the district must take into consideration such problems as the outlet for tile systems, bank protection, and slopes suitable for proper maintenance. Actual drainage work is being done by contract between the local drainage association and contractor, with provisions for inspection and supervision by the district.

Conservationist Binnie believes that initial success of the Knox watershed plan can be attributed to close cooperation of all local agencies including the district supervisors, the Extension Service, Triple-A, the CCC-camp administrators, the Farm Security Administration, and the Soil Conservation Service. Supervisors of the district are John Wolfe, chairman, Ivol Myers, N. Y. Yates, Lester Williams, and Charles Stevens. Stevens probably reflects the opinion of the group in this remark: "The trouble with us is that we got started 20 years too late. As an advisor to the F. S. A. I get to see a good many farms in all parts of the county and I believe that most farmers do not realize the damage already done by erosion."

CONSERVATION FOR SMALL FARMS

(*Continued from p. 27*)

utilized for various purposes, indicate the balance of enterprises called for, and help him to obtain the necessary assistance from the proper persons or agencies to enable him to utilize this available land to give him a farm income as nearly adequate as possible.

In the final analysis, however, our farm planners cannot hope to make satisfactory farm plans unless they obtain sufficient information concerning the economic aspects of the farms they are planning to enable them to forecast the economic consequences of the conservation plans they propose to apply to the farms. In order to make a sound forecast of the economic consequences of a farm plan, the planner must know the present sources and amount of the farmer's income and also the amount of his expenses. He must then judge to the best of his ability the probable effects his proposed farm plan will have on income and expenses. If the result of his weighing of the facts is seriously unfavorable, the planner must cast about for means of remedying conditions on the farm without sacrificing the basic objective of conserving the soil.

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Compiled by ETTA G. ROGERS, Publications Unit

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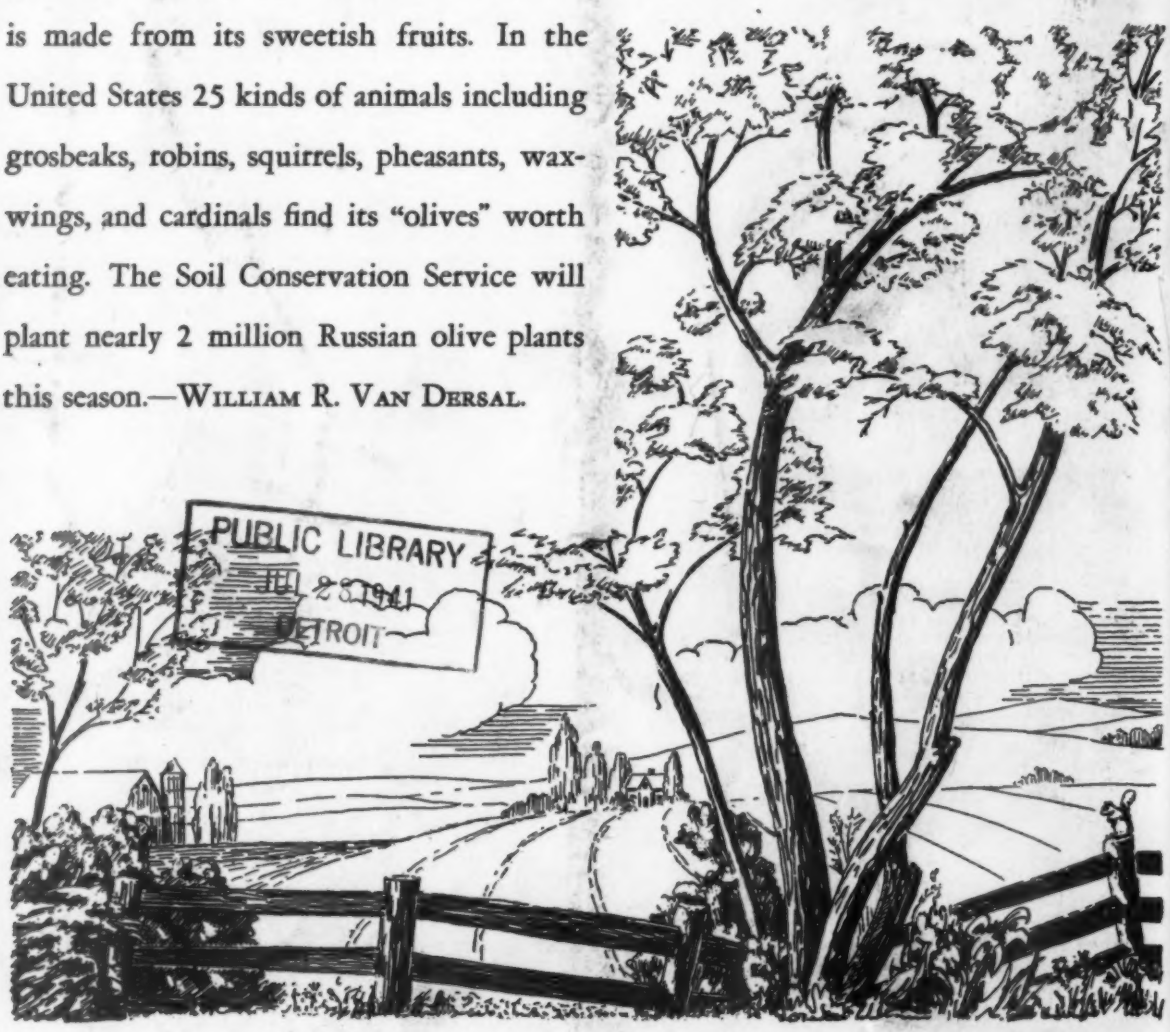
[1] From Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

RUSSIAN OLIVE—neither an olive nor exclusively Russian, but *Elaeagnu angustifolia* from southern Europe and western Asia—has turned out to be a plant of considerable worth for soil conservation planting, particularly in the western half of the United States. First introduced in 1897, it has since gone wild in several Western States where it has proved itself able to withstand extreme drought, cold, and considerable concentration of alkali.

For several centuries this shrub or small tree has been used in Europe for ornamental planting, a purpose it serves well in this country also. In the Orient a kind of sherbet is made from its sweetish fruits. In the United States 25 kinds of animals including grosbeaks, robins, squirrels, pheasants, waxwings, and cardinals find its "olives" worth eating. The Soil Conservation Service will plant nearly 2 million Russian olive plants this season.—WILLIAM R. VAN DERSAL.



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